

WHAT IS CLAIMED AS NEW AND DESIRED TO BE SECURED BY LETTERS

PATENT OF THE UNITED STATES IS:

1. A valve assembly for a gas purification system in which the gas purification system includes a plurality of vessels each having a first port opening and a second port opening, the valve assembly comprising:

a motor adapted to rotate continuously;

a converting mechanism that converts continuous movement of said motor into intermittent movement;

a first valve element having a first aperture to selectively connect a first port opening of one of said plurality of vessels to an outlet of the first valve element, said first valve element further including a first passageway for selectively interconnecting first port openings of a pair of said plurality of vessels, wherein said first valve element is intermittently moved by said motor and said converting mechanism such that each intermittent movement changes the vessel connected to said first aperture and changes the pair of vessels connected by said first passageway; and

a second valve element having a second aperture to selectively connect a second port opening of one of said plurality of vessels to an input of the second valve element, wherein said second valve element is intermittently moved by said motor and said converting mechanism such that each intermittent movement changes the vessel connected to said second aperture.

2. The valve assembly of Claim 1, wherein said first aperture and said second aperture are concurrently connected to a first port opening and a second port opening, respectively, of a same one of said plurality of vessels.

3. The valve assembly of Claim 1, further comprising:

a flow control member arranged to control a fluid flow within said first passageway.

4. The valve assembly of Claim 1, wherein said second valve element comprises:

a third aperture to selectively connect a second port opening of another one of said plurality of vessels to an output of the second valve element, wherein each intermittent movement of said motor and said converting mechanism changes the vessel connected to said third aperture.

5. A valve element comprising:

a first disc including two holes;

a second disc positioned adjacent to said first disc, said second disc including,

two apertures arranged to align with said two holes, and

a first passageway arranged to allow fluid communication between said two apertures; and

a driving unit arranged to rotate said second disc relative to said first disc in an intermittent manner such that a positional relationship between said two holes and said two apertures is changed.

6. The valve element of Claim 5, further comprising:

a flow control member arranged to control a fluid flow within said first passageway.

7. The valve element of Claim 5, wherein said driving unit is arranged to rotate said second disc in an intermittent manner such that one of said two apertures is rotated from one of said two holes to another one of said two holes.

8. The valve element of Claim 5, wherein said motor assembly comprises:

a motor arranged to produce continuous rotational movement; and

a converting mechanism arranged to translate said continuous rotational movement into an intermittent rotation.

9. The valve element of Claim 5, wherein,

said first disc includes five holes, and

said second disc includes a first aperture, a second aperture, a third aperture, a fourth aperture, and a fifth aperture respectively arranged to align with said five holes.

10. The valve element of Claim 9, wherein,

said first and fifth apertures are connected by a second passageway,

said second and fourth apertures are connected by a third passageway, and

said two apertures correspond to said second aperture and said fifth aperture.

11. The valve element of Claim 5, further comprising:

adjusting components arranged to vary a fluid flow rate within said second and third

passageways.

12. The valve element of Claim 5, wherein,

said first disc is positioned between said driving unit and said first valve element,

said first disc includes a center hole, and

said driving unit is rotatably connected to said second disc via a shaft positioned in

said center hole.

13. The valve element of Claim 5, further comprising:

sealing components positioned between said first and second discs, said sealing components being arranged to maintain a fluid seal between said first and second discs during an intermittent rotation between said first and second discs.

14. A fluid treatment system comprising:

a plurality of vessels each having a first port opening and a second port opening;

a first valve element having a first aperture to selectively connect a first port opening of one of said plurality of vessels to an outlet of the first valve element;

a second valve element having a second aperture to selectively connect a second port opening of one of said plurality of vessels to an input of the second valve element;

a motor adapted to rotate continuously; and

a converting mechanism that converts continuous movement of said motor into intermittent movement, wherein said first and second valve elements are intermittently moved by said motor and said converting mechanism such that the intermittent movement

changes the vessel connected to said second aperture and the vessel connected to said first aperture.

15. The fluid treatment system of Claim 14, wherein,
said first and second valve elements are connected by a rod, and
said plurality of vessels are positioned on different sides of said rod and between said first and second valve elements.

16. The fluid treatment system of Claim 14, wherein at least one of the plurality of vessels includes adsorbent material.

17. The fluid treatment system of Claim 14, wherein each of said first and second valve elements is cylindrically shaped.

18. A valve assembly for a gas purification system in which the gas purification system includes a plurality of vessels each having a first port opening and a second port opening, the valve assembly comprising:

a first valve element having first through fifth apertures arranged in a circular manner on a first surface of said first valve element, wherein,

said first aperture is arranged to selectively connect a first port opening of one of said plurality of vessels to an outlet of the first valve element, said outlet being positioned on a second surface of said first valve element,

said fourth aperture is connected to said second aperture by a first passageway, and

said fifth aperture is connected to said first aperture by a second passageway and to said second aperture by a third passageway;

a second valve element having sixth through eighth apertures on a first surface of said second valve, wherein,

said sixth aperture is arranged to selectively connect a second port opening of said one of said plurality of vessels to an input of the second valve element,

said input being positioned on a second surface of said second valve element, and
said seventh and eighth apertures are arranged to selectively and
respectively connect second ports of two of said plurality of vessels to two outlets
positioned on a third surface of said second valve element.

19. The valve assembly of Claim 18, wherein said first and second valve elements are
rotatable relative to said plurality of vessels.

20. The valve assembly of Claim 18, wherein
said first and second valve elements are connected by a rod, and
said plurality of vessels is arranged on different sides said rod.

21. The valve assembly of Claim 18, further comprising:

a flow control member adapted to control a fluid flow within said third passageway.

22. A method of handling a fluid in a gas purification system including a plurality of
vessels selectively connected to apertures of a first valve element, comprising the steps of:

(i) positioning said first valve element in a first position to remove a product fluid
from a first port opening of a first one of said plurality of vessels;

(ii) moving said first valve element by intermittent rotation to a second position to
depressurize said first vessel in a first direction;

(iii) moving said first valve element by intermittent rotation to a third position to
depressurize said first vessel in a second direction, said second direction being directly
opposite to said first direction;

(iv) moving said first valve element by intermittent rotation to a fourth position to
purge impurities from said first vessel; and

(iv) moving said first valve element by intermittent rotation to a fifth position to
repressurize said first vessel.

23. The method of Claim 22, said step (i) comprising the step of:

removing impurities from a feed fluid to create said product fluid.

24. The method of Claim 22, further comprising the step of:
converting a continuous movement of a motor to an intermittent rotation for moving
said first valve element to each of said second, third, fourth, and fifth positions.
25. The method of Claim 22, said step (iv) comprising the step of:
purging said impurities from said first vessel with a product fluid transferred from a
second one of said plurality of vessels via a first passageway of said first valve element, said
first valve element being positioned at said second position with respect to said second
vessel.
26. The method of Claim 25, said step (v) comprising the step of:
repressurizing said first vessel with product fluids transferred from third and fourth
ones of said plurality of vessels respectively via second and third passageways of said first
valve element, said first valve element being positioned at said first position with respect to
said third vessel and at said second position with respect to said fourth vessel.
27. The method of Claim 26, said step (v) comprising the step of:
controlling a flow of said product fluid within said third passageway with a check
valve.
28. The method of Claim 22, wherein step (i) comprises the step of:
positioning a second valve element at said first position to provide said feed fluid to a
second port opening of said first vessel.
29. The method of Claim 28, wherein step (iii) comprises the step of:
positioning said second valve element at said third position to remove an initial tail
fluid from said second port opening of said first vessel.
30. The method of Claim 29, wherein step (iv) comprises the step of:
positioning said second valve element at said fourth position to remove a purged tail
fluid from said second port opening of said first vessel.